

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Irving W. DeVoe
Serial No: 10/626,209
Confirmation No: 9677
Filed: July 24, 2003
For: SYSTEM AND METHOD FOR CONVERTING KINETIC
ENERGY OF GASES OR LIQUIDS TO USEFUL
ENERGY, FORCE AND WORK
Examiner: Krishnan S. Menon
Art Unit: 1723

AFFIDAVIT OF TING WANG, PH.D.

1. I, Ting Wang, Ph.D., submit this affidavit on the basis of my own personal knowledge and experience, and I am competent to testify to the matters herein should I be called upon to do so.
2. First, let me brief my qualification to justify my professional opinions rendered in this Affidavit. I hold a Master degree in mechanical engineering from the State University of New York at Buffalo (1981) and Ph.D. from the University of Minnesota (1984). I have conducted research for the past 27 years for various government agencies and companies such as NASA, U.S. Air Force, U.S. Navy, National Science Foundation, Department of Energy, U.S. Agency of International Development (USAID), General Electric Company, Siemens Westinghouse Company, Dynegey, CII Carbon, and 3M Company.
3. I have published more than 140 papers in top ranked international journals and conference proceedings and written more than 50 technical reports. I have served as an organizer in many conferences and reviewer for most of the journals in my field. I am a Fellow of the American Society of Mechanical Engineers (ASME) and a senior member of the American Institute of Aeronautics and Astronautics

(AIAA). I was awarded the George Westinghouse Silver Medal by ASME in 1998. I was appointed by former Louisiana Governor "Mike" Foster to serve as a member of the Comprehensive Energy Policy Advisory Commission. Currently, I am the Director of the Energy Conversion & Conservation Center, a tenured full professor of Mechanical Engineering, and the Jack & Reba Matthy Endowed Chair in Engineering at the University of New Orleans (UNO).

4. I have read the application, including the claims, read and considered the issues raised by the Examiner in the action mailed on December 5, 2006 in Irving DeVoe's U.S. patent application, and my discussion of the Examiner's questions regarding the above referenced patent application proceeds in accordance with the questions raised by the Examiner.
5. It seems the main Examiner's concern is associated with the primary energy source of the system. This concern was clearly revealed in the beginning of the Examiner's question and permeates throughout the later questions and concerns in different forms. The page-to-page discussions are summarized as follows.
6. Page 2, bottom two lines:
 - a. Examiner's concern " ... It shows that 1634kWh per day of energy is derived from nowhere, which is against the known principles of physics. Therefore the process is not enabling."
 - b. Discussion: The primary energy source of the osmotic pressure is from the environment. Whenever a solute movement is blocked by the membrane, it will transfer momentum to it, and therefore, generate pressure on it. The solute molecular momentum is powered by the ambient temperature. The osmotic pressure can be calculated by van't Hoff formula: $P=cRT$, where c is the solute concentration, R is the gas constant, and T is the absolute temperature.

Although the source of energy is clearly stated in the patent application on page 3, Sections [0024] and [0025], the Examiner was apparently not

noticing. As further evidence that the energy comes from the environment, I recommend that he also review patent application section [0037]~[0040].

7. Page 3, Lines 4-6:

- a. Examiner's concern: ".. applicant's process appears to be generating energy from nowhere. Lines 15-25 in page 18 describes vacuum as the source of energy, and that lowering the vaporization temperature would conserve energy."
- b. Discussion: Again, since the examiner did not recognize that primary energy comes from the environment, he was probably continuously searching for the energy source. The vacuum generated by the osmosis process is a pleasant by-product, but it should not be treated as the primary energy source because the most power the vacuum can provide is derived from one bar pressure force. Once the Examiner realizes that the primary energy source for the applicant's system is derived from the ambient temperature, this concern should be removed.

8. In the middle of Page 4:

- a. Examiner's concern: "Since the claimed invention uses vacuum as the power source, and the above paragraphs indicate the energy is derived from the system itself for generating the vacuum and no other energy is supplied for evaporating solvent, the process as disclosed and claimed is unsustainable, and therefore, non-enabling."
- b. Discussion: There seems to be a misinterpretation of the application context on the Examiner's part. It seems the Examiner interpreted the optional method, as suggested in the patent application, for producing the vacuum by using the power generated by the system as an evidence of a perpetual machine; therefore, he judged the claimed system as "unsustainable." Again, this is another extension of the Examiner's earlier concern of "lack of the primary energy source."

My interpretation of the context in the application is this: The application intends to claim the concept of using vacuum to separate the solution and solute for patent protection. Although vacuum can be generated by osmosis process in the claimed system, the application clearly wants to include other means of creating vacuum under the claimed coverage, including, for example, using the electricity produced by the system itself. Since the primary energy source relies on the ambient energy, the energy required to produce vacuum is only a parasitic power. It is clear that using the osmosis process to produce vacuum as a by-product can save energy and is a better choice than using other energy to create vacuum.

9. Pages 5 & 6:

- a. The Examiner intends to explain the concept of creating vacuum in an osmosis system is not new by citing Loeb's patent (1975, U.S. patent 3,906,250). Line 5: ", and the solvent chamber has a vacuum (because pressure is zero atm in figure 3 and 4 in river water chamber). Line 12: " Under the principles of inherency, if a prior art device, in its normal and usual operation, would necessarily perform the method claimed, then the method claimed will be considered to be anticipated by the prior art device."
- b. Discussion: After read the Loeb's patent, I feel the pressure value used in Loeb's patent could be gauge pressure, i.e. the relative pressure above the atmospheric pressure. Therefore, "zero pressure" mentioned in Loeb's patent could be interpreted as "at one absolute atmospheric pressure." The reasons are:
 - (i) The Loeb's patent does not clearly stress whether the solution chamber (the river water side) is sealed or not. If it is not sealed, the pressure is likely to be at zero gauge (or one absolute atmospheric pressure).
 - (ii) If the solution chamber were vacuum, the Loeb's patent does not clearly explain why and how this vacuum can happen. The word

"vacuum" and the concept that vacuum can be generated by osmosis process had not been mentioned in Loeb's patent. The "vacuum" in DeVoe's application is a by-product of the osmosis, a person skilled in the art may or may not realize "vacuum" will be formed by osmosis process, and it requires specific knowledge and design to harvest the benefit of vacuum.

(iii) By comparing Fig. 2a and Fig. 2b in Loeb's patent, one could reasonably conclude that the solution chamber in Loeb's patent is probably not sealed because the pressure is at zero in both figures when the solution level is at the same elevation as the solvent chamber in Fig. 2a as well as when the solution level is lower in Fig. 2b. The pressure in the solution chamber in Fig. 2a should be less than the pressure in Fig. 2b if vacuum is maintained in the solution chamber. It is not clear how the pressure could be at the absolute zero in Fig. 2a before the osmosis starts. Therefore, it can be concluded that the pressure used in Loeb's patent is gauge pressure, and the solution chamber is not sealed.

(iv) In Loeb's patent, column 5, lines 38 and 39: "As the sea water passes through hydroturbine generator 17, its hydraulic pressure is released to zero (Point D)..." It can be seen in Fig. 3 that Point D is not connected to Point 18. If Point 18 were vacuum at absolute zero pressure, Point D should be also at absolute zero pressure. Since the Loeb's patent does not clearly indicate how the vacuum at absolute zero pressure is obtained or maintained at Point D, the most probable explanation is that the zero pressure in Loeb's patent means gauge pressure.

10. Page 7, Line 12:

- a. Examiner's concern: "Using vacuum for evaporation, particularly at ambient temperature, is known in the art."
- b. Discussion: Although I don't think Loeb's patent specifically takes advantage of the osmosis-generated vacuum or ever stresses the benefit of vacuum, I agree that using vacuum to speed up the evaporation process is

a common industrial process. However, whether the concept of effectively utilizing the vacuum **generated by the osmosis** is innovative is subject to legal scrutinization, which is not within my expertise. In Loeb's patent, evaporation ponds, which is not at vacuum, are used to vaporize the solution.

11. Overall opinion: The primary energy of the osmosis process comes from the environment. This driving energy source is the same in Loeb's patent as in DeVoe's patent application. Actually, the energy source has been more clearly explained in DeVoe's application than in Loeb's patent.

12. I don't think it is easy to design a system that can successfully harvest the energy produced by osmotic pressure. Therefore, the entire system is innovative to me and should be somehow protected by the law.

I hereby swear under the pains and penalties of perjury that the foregoing is true to the best of my knowledge and belief.

FURTHER AFFIANT SAYETH NOT.

Date: June 4, 2007



Ting Wang, Ph.D.